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(54) **GEARBOX LOCK MECHANISM**

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(51) **Int. Cl.**

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E02F 9/20	(2006.01)
E21B 17/02	(2006.01)
E21B 7/02	(2006.01)

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CPC A01C 5/04; A01K 97/01; E02F 3/06; E02F 9/202; E21B 3/06; E21B 3/045; E21B 7/008; E21B 7/021; E21B 7/02; E21B 7/028; E21B 7/005; E21B 10/44; E21B 17/003; E21B 17/22; E21B 17/046; E21B 19/028; E21B 19/16; E21B 19/18; F25C 5/04

USPC 172/111; 173/26, 39, 146; 175/18, 394, 175/320, 323, 408, 424, 121, 145, 160, 175/162; 299/87.1

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,622,704	A *	3/1927	Coil	173/26
1,951,192	A	3/1934	Hantjopoulos	
2,273,203	A	2/1942	Keene et al.	

(Continued)

FOREIGN PATENT DOCUMENTS

WO	2010/025500	A1	3/2010
WO	2012/031108	A1	3/2012

OTHER PUBLICATIONS

International Search Report and Written Opinion mailed Feb. 1, 2012 in International Application No. PCT/US2011/050189, 14 pages.

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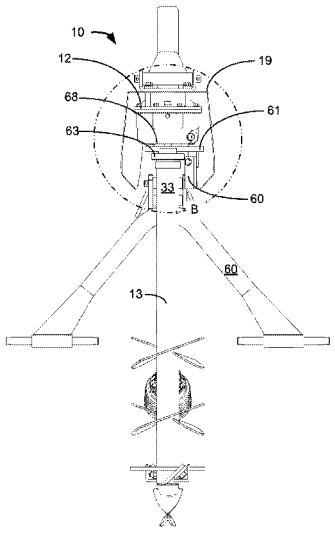
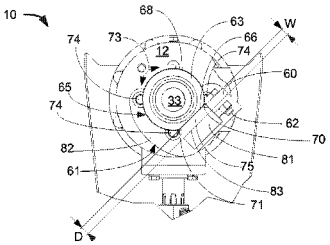
(57) **ABSTRACT**

The gearbox lock mechanism for a post bole auger has a collar coupled to a lower end of a right angle gearbox, the collar rotatable upon operation of the gearbox. The collar comprises a semi-circular outer edge and a flat side. A male-threaded nipple extends from the collar and threads onto the auger shaft. A lock bar is coupled to the gearbox and acts as a positive lock to lock the collar in place for removal of the shaft from the gearbox. The lock bar is rotatable from a locked position whereby the lock bar is aligned with and contactable with the flat side of the outer edge of the collar, to an unlocked position whereby the lock bar does not contact the flat side of the outer edge of the collar.

18 Claims, 5 Drawing Sheets





(51) **Int. Cl.**
E21B 19/18 (2006.01)
E02F 3/06 (2006.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,320,610	A		6/1943	Kandle
2,401,250	A		5/1946	Kandle
2,838,285	A		6/1958	Gredell
2,890,860	A	*	6/1959	Smith 173/140
2,912,228	A		11/1959	Kandle
3,093,199	A		6/1963	Premo
3,235,018	A		2/1966	Troeppl
3,375,890	A		4/1968	Petersen
3,710,877	A		1/1973	Michasiw
3,902,562	A		9/1975	Pessier et al.
3,998,283	A		12/1976	Chitwood et al.
D267,405	S		12/1982	Wilson
4,819,744	A		4/1989	Caswell
5,507,354	A	*	4/1996	Harleman 175/162
5,820,319	A		10/1998	Hull et al.
6,151,810	A	*	11/2000	Mukai 37/350
6,216,803	B1		4/2001	Deken
6,655,476	B2		12/2003	Groce, Jr. et al.
6,725,950	B2	*	4/2004	Palm 175/162
7,036,606	B2	*	5/2006	Rossi 173/28
7,210,543	B1	*	5/2007	Sumner 175/323
7,699,119	B1	*	4/2010	Lunde et al. 175/18
2012/0048624	A1		3/2012	Fraley et al.
2013/0014997	A1		1/2013	Fraley et al.

* cited by examiner

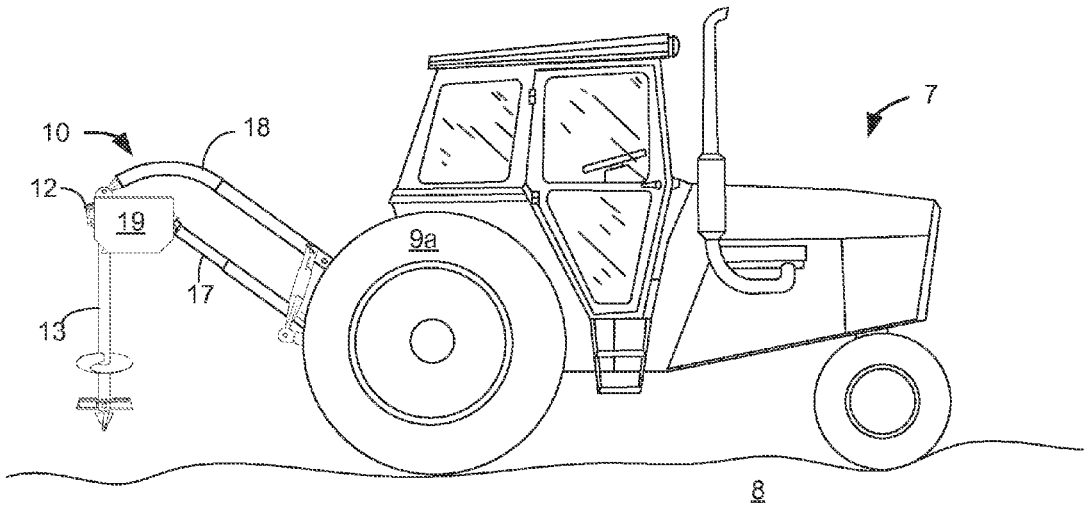


Fig. 1

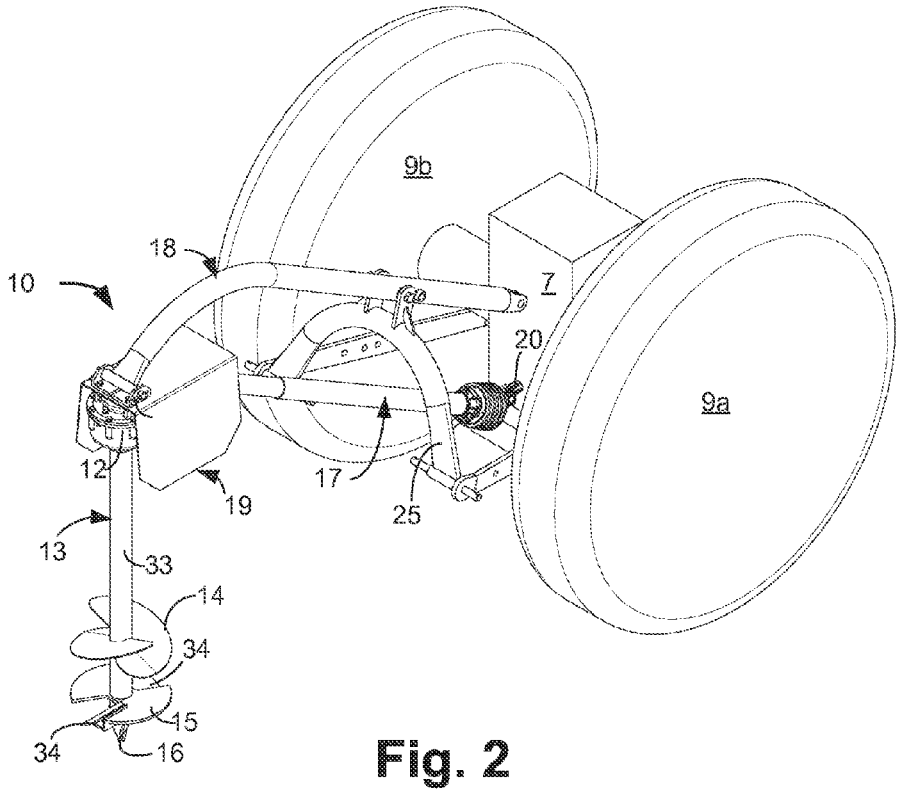


Fig. 2

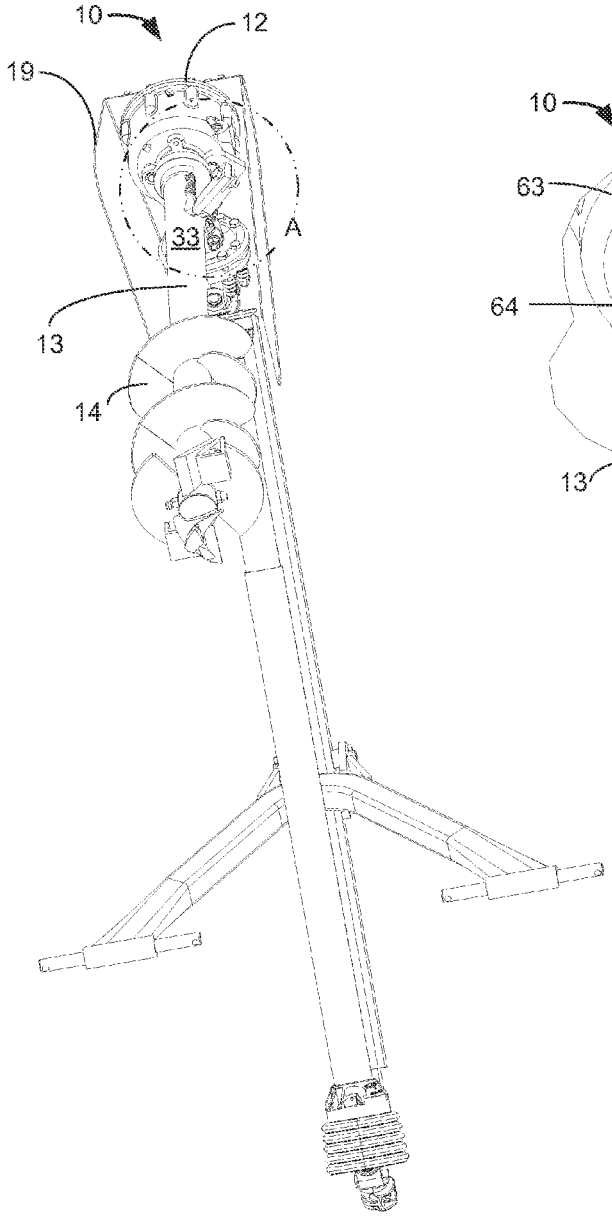


Fig. 3

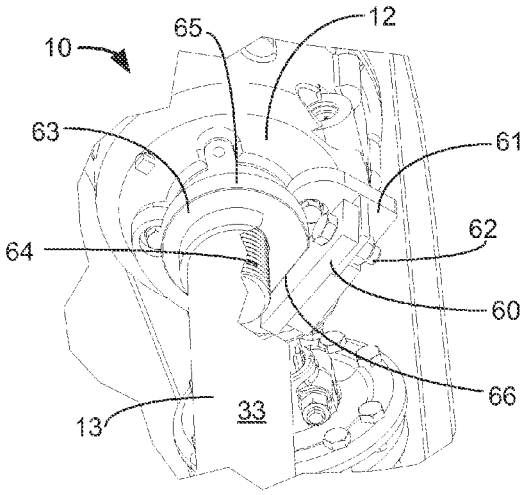


Fig. 4

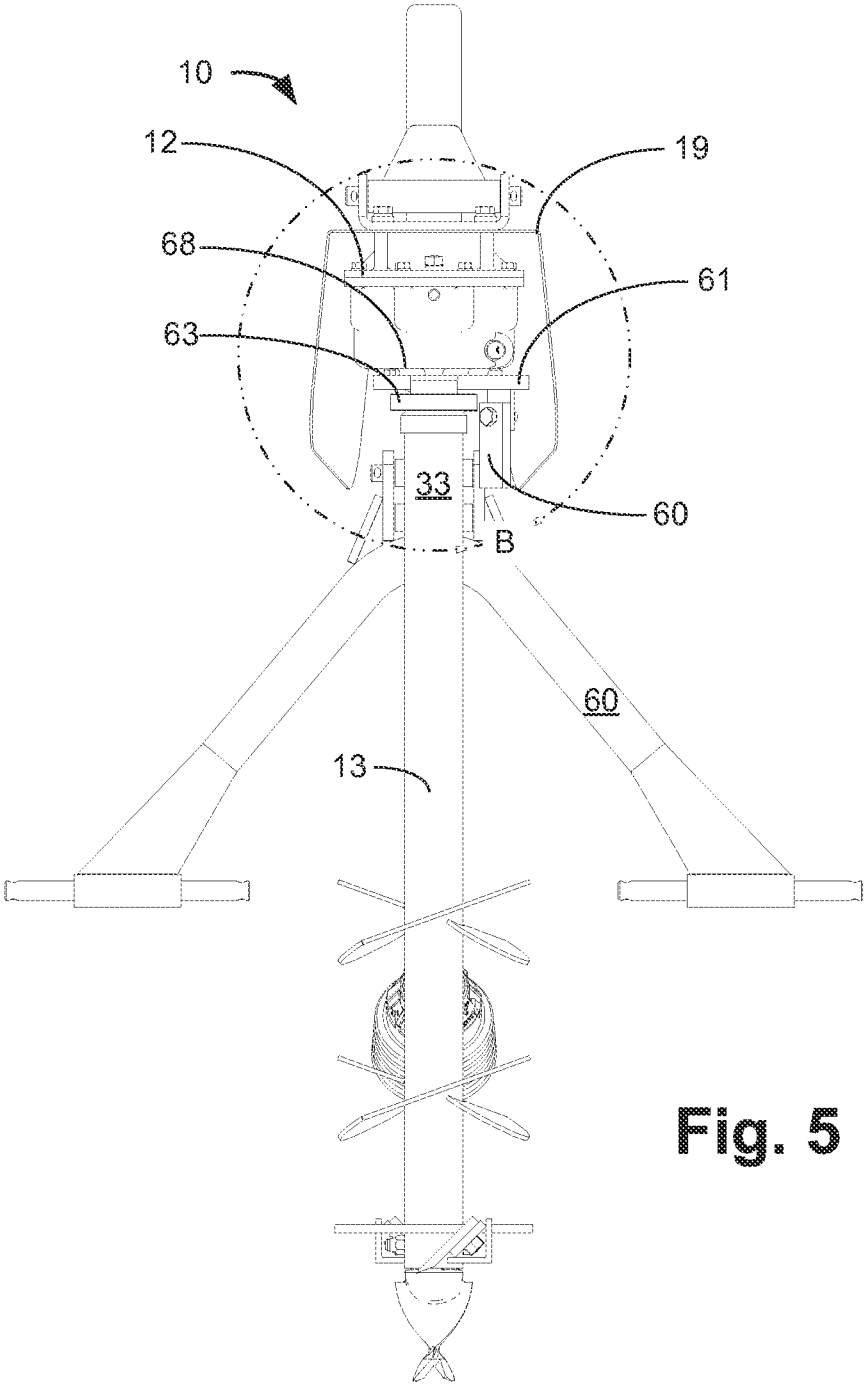


Fig. 5

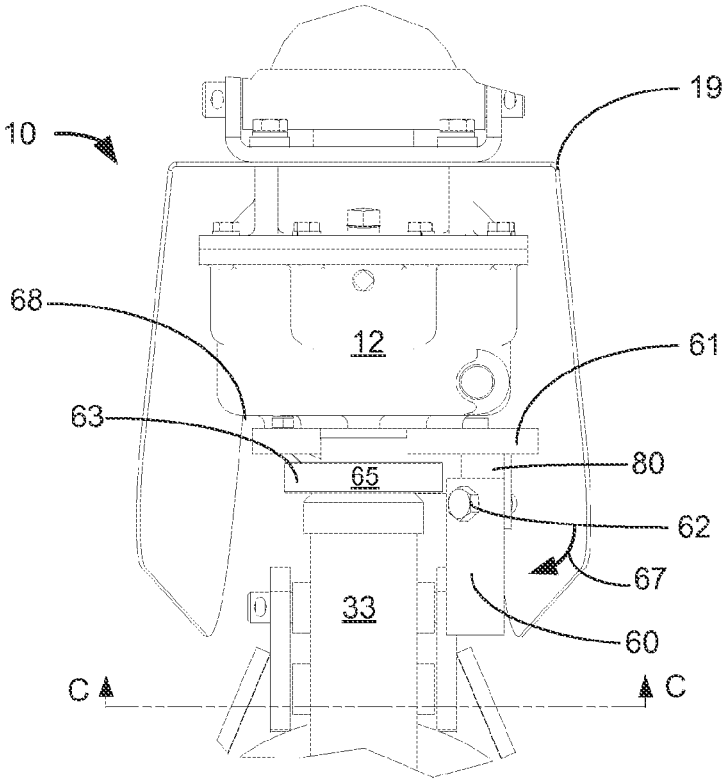
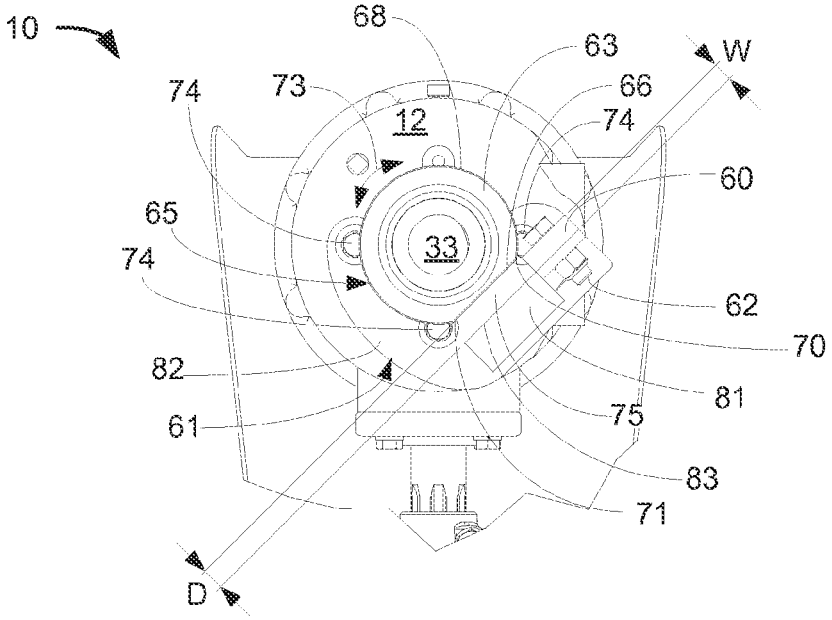

10
19
68
12
61
63
65
80
62
67
33
60
C
C

Fig. 6


10
68
63
W
74
73
66
12
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60
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33
74
62
70
82
81
61
75
83
71
D

Fig. 7

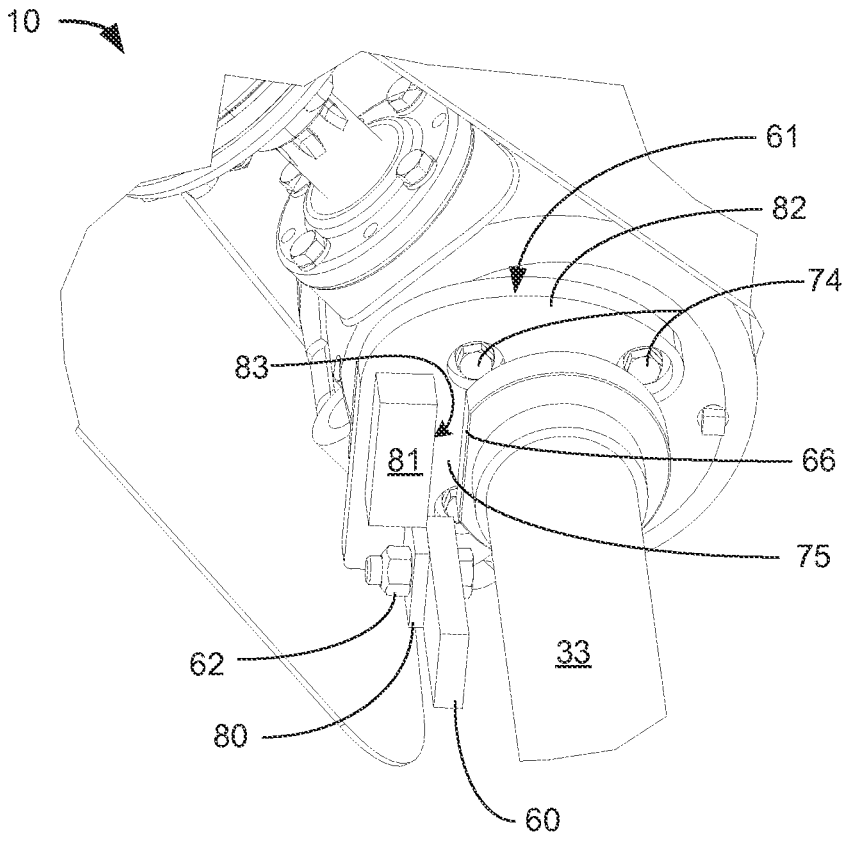

Fig. 8

GEARBOX LOCK MECHANISM

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 61/753,307 filed on Jan. 16, 2013, the entire contents of which are herein incorporated by reference.

BACKGROUND AND SUMMARY

A post hole digger attaches to the standard three point hitch of the tractor is powered by the tractor's power take-off (PTO). The digger comprises an auger without protrusions or other extending parts above the fighting of the auger, to reduce the possibility of a user becoming ensnared during use of the digger.

A gearbox translates rotation from the PTO shaft to the auger. In a traditional post hole digger, the auger's shaft attaches to the gearbox via a cross bolt that extends perpendicularly through the shaft. The cross bolt has the disadvantage of protruding from the shaft, and causing potential harm to a user. The digger of the present disclosure removes this disadvantage by providing a threaded fitting between the shaft and the gearbox. However, a threaded fitting on the rotating shaft provides an additional challenge When the auger needs to be removed from the gearbox.

The gearbox lock mechanism of the present disclosure comprises a collar coupled to a lower end of the gearbox, the collar rotatable upon operation of the gearbox. The collar comprises a semi-circular outer edge and a flat side. A male-threaded nipple extends from the collar and threads into the auger shaft. A lock bar is coupled to the gearbox and acts as a positive lock to lock the collar in place for removal of the shaft from the gearbox. The lock bar is rotatable from a locked position whereby the lock bar is aligned with and contactable with the flat side of the outer edge of the collar, to an unlocked position whereby the lock bar does not contact the flat side of the outer edge of the collar.

For purposes of summarizing the invention, certain aspects, advantages, and novel features of the invention have been described herein. It is to be understood that not necessarily all such advantages may be achieved in accordance with any one particular embodiment of the invention. Thus, the invention may be embodied or carried out in a manner that achieves or optimizes one advantage or group of advantages as taught herein without necessarily achieving other advantages as may be taught or suggested herein.

BRIEF DESCRIPTION OF THE DRAWINGS

The disclosure can be better understood with reference to the following drawings. The elements of the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the disclosure. Furthermore, like reference numerals designate corresponding parts throughout the several views.

FIG. **1** is a side plan view of a post hole digger coupled to a tractor.

FIG. **2** is a rear perspective view of the post hole digger of FIG. **1**.

FIG. **3** is a bottom perspective view of the digger.

FIG. **4** is an enlarged detail view of the digger of FIG. **3**, taken along detail line A of FIG. **3**.

FIG. **5** is a rear plan view of the digger of FIG. **1**.

FIG. **6** is an enlarged detail view of the digger of FIG. **5**, taken along detail line B of FIG. **5**.

FIG. **7** is a cross sectional view of the digger of FIG. **6**, taken along section lines C-C of FIG. **6**.

FIG. **8** is a partial enlarged bottom view of the digger of FIG. **6**.

DETAILED DESCRIPTION

FIG. **1** is a side plan view of a post hole digger **10**. The digger **10** is shown installed on a tractor **7** and is used to dig generally-cylindrical holes (not shown) in the ground **8**, for example, holes for fence posts. The digger **10** is disposed at the rear of the tractor **7** between the rear wheels **9***a* and **9***b* (FIG. **2**) of the tractor **7**.

The digger **10** comprises an auger **13** for drilling into the ground **8**. The digger **10** is disclosed in U.S. Non-Provisional Patent Application Serial No. 13/548,836, titled "Post Hole Digger," published on Jan. 17, 2013, under Publication No. US-2013-0014997-A1, which is incorporated herein by reference in its entirety.

The auger **13** is supported by a top support arm **18** that extends from the tractor **7**. A rotating shaft **17** extends from a PTO shaft **20** (FIG. **2**) of the tractor **7** and translates rotation from the PTO shaft **20** to a gearbox **12**, and ultimately to the auger **13**. A shield **19** covers moving parts (not shown) of the gearbox **12** that could otherwise pose a safety hazard to users not shown) of the digger **10**.

FIG. **2** is a rear perspective view of the digger **10** installed on the tractor **7** between the rear wheels **9***a* and **9***b* of the tractor **7**. The digger **10** connects to the tractor's standard three point hitch that is known in the art. The term "three point hitch" refers to the three mounting points of a tractor hitch that extend rearwardly from the rear of the tractor **7**.

The top support arm **18** is rotatably affixed to the shield **19** that covers the gearbox **12**. A support frame **25** supports the top support arm **18**. The shield **19** is rigidly affixed to the gearbox **12**, and is not detachable from the digger in this embodiment without making the digger non-fictional, to provide safety for the user.

The rotating shaft **17** is releasably coupled to the PTO shaft **20** of the tractor **7**. As known by persons of skill in the art, a power-take off shaft is a splined shaft that is rotatable by the user (not shown) upon actuation of the tractor controls (not shown). Rotation of the PTO shaft **20** typically powers farming implements such as the digger **10**. The rotating shaft **17** extends from the PTO shaft **20** to the gearbox **12**, as further discussed herein.

The gearbox **12** is a right angle gearbox that receives rotation from the rotating shaft **17** and translates the received rotation to the auger **13**. In this embodiment, the auger **13** comprises a rotatable auger shaft **33**, a plurality of fighting blades **14** and a cutting head **15**. The cutting head **15** is disposed at the lowermost end of the shaft **33**, and comprises a pilot bit **16** and a pair of cutting blades **34**. The fighting blades **14** are disposed above the cutting head **15**.

The outer surface of the shaft **33** is generally smooth above the fighting blades **14**, and has no protrusions or other irregularities above the fighting blades **14** that may ensnare or entangle a user during use. This is an improvement over prior art augers which contain protrusions from the shaft that can endanger a user.

FIG. **3** is a bottom perspective view of the digger **10**. The gearbox **12** is disposed beneath the shield **19**, The auger **13** comprises a shaft **33** that extends from the gearbox **12**. Between the gearbox **12** and the flighting **14**, the shaft **33** is smooth, i.e., has no protrusions that could catch on a user or the user's clothing.

FIG. **4** is an enlarged detail view of the digger **10** of FIG. **3**, taken along detail "A" of FIG. **3**. A collar **63** extends beneath the gearbox and is rigidly affixed to a male-threaded nipple **64** that releasably affixes the shaft **33** to the gearbox **12**. In the illustrated embodiment the collar **63** is unitary with the nipple **64**. The collar has a semi-circular outer edge **65** that is primarily semi-circular and has a flat side **66**. The collar **63**, threads **64** and shaft **33** rotate when the digger **10** (FIG. **1**) is in operation.

A lock bar support **61** is coupled to the gearbox **12** between the collar **63** and the gearbox **12**. The lock bar support **61** does not rotate. A lock bar **60** is rotatably coupled to the lock bar support **61** via a fastener **62**.

When the digger **10** is in operation, the lock bar **60** is in an "unlocked" position such that the lock bar **60** extends downwardly. When the user desires to remove the auger **13** (FIG. **3**) from the gearbox **12**, the user manually moves the lock bar **60** to a "locked" position such that the lock bar **60** is rotated upwardly until it contacts the lock bar support **61**. In this orientation, the lock bar **60** is generally parallel to the flat side **66** of the collar **63**. When the lock bar **60** is in the locked position, the flat side **66** contacts the lock bar **60** and prevents the collar **63** from rotating. Thus the term "locked" refers to the collar **63** being locked such that it cannot rotate, and the term "unlocked" refers to the collar being rotatable. When the collar **63** is locked, the user can remove the auger **13** from the digger **10** by unscrewing the shaft **33** from the threaded nipple **64**.

FIG. **5** is a rear plan view of the digger **10** of FIG. **1**. The lock bar support **61** is rigidly coupled to a bottom side **68** of the gearbox **12**. In one embodiment, the lock bar support **61** is affixed to the gearbox **12** via a plurality of fasteners (not shown). The lock bar support **61** is generally parallel to the collar **63**. The lock bar **60** extends downwardly from the lock bar support **61** when the lock bar **60** is in its unlocked position, as shown. In this unlocked position, the lock bar **60** is generally perpendicular to the lock bar support **61** and the collar **63**.

FIG. **6** is an enlarged detail view of the digger **10** of FIG. **5**, taken along detail line "B" of FIG. **5**. The lock bar **60** is shown in its unlocked position. From this unlocked position, the lock bar **60** is rotatable upwardly in the directly indicated by directional arrow **67**. The lock bar **60** is generally rectangular, with long opposed sides extending downwardly when it is in the unlocked position.

The lock bar support **61** is comprised of a generally flat support plate **82** and a downwardly extending tab **80** that is generally perpendicular to the support plate **82**. The lock bar **60** is rotatably affixed to the tab **80** via the fastener **62**, which may be a bolt and nut. The support plate **82** and tab **80** are made of steel in one embodiment, though other suitably strong and rigid materials could be used.

FIG. **7** is a cross sectional view of the digger **10** of FIG. **6**, taken along section lines C-C of FIG. **6**, with the lock bar **60** shown in its unlocked position. In this position, the lock bar **60** cannot contact the collar **63**, thus the collar **63** is free to rotate. The support plate **82** of the lock bar support **61** is a curved plate with a generally flat cross section and is coupled to the gearbox **12** via a plurality of fasteners **74**. Note that the support plate **82** is coupled to the non-rotatable outer body of the gearbox **12**, in contrast with the collar **63**, which rotates upon operation of the gearbox **12**. The support plate **82** extends over halfway around the gearbox **12** when viewed from the bottom as shown.

The lock bar support **61** further comprises a block stop **81** that is rigidly affixed to the support plate **82** adjacent to the lock bar **60** when the lock bar **60** is in the locked position. The block stop **81** comprises a generally rectangular box, generally made of steel, that is substantially parallel to and spaced apart from the flat side **66** of the collar **63** when the collar **63** is locked. The block stop **81** being spaced apart from the flat side **66** creates a gap **75** between the block stop **81** and flat side **66**. The width of this gap **75**, i.e., the distance "D" between an inner surface **83** of the block stop **81**, is slightly larger than a width "W" of the lock bar **60**. This is desired because when the lock bar **60** is locked, it is disposed between the inner surface **83** of the block stop **81** and the flat side **66** of the collar **63**.

The outer edge **65** of the collar **63** comprises the flat side **66** and a semi-circular portion **68** that extends more than 270 degrees around the collar. In other words, the flat side **66** in effect "cuts off" the outer edge **65**, generally less than 90 degrees around the outer edge **65**. Corners **70** and **71** on the outer edge **65** provide a transition from the semi-circular portion **68** to the flat side **66** of the outer edge **65**.

Note that the distance "D" must be sufficient so that the semi-circular portion **68** of the outer edge **65** of the collar **63** clears the block stop **81** when the lock bar **60** is in the unlocked position.

When the lock bar **60** is locked, the lock bar **60** is generally parallel to the flat side **66** of the collar **63** and the inner surface **83** of the block stop **81**. If the collar **63** is urged to rotate in either direction indicated by directional arrow **73**, one of the corners **70** or **71** will contact an inner side (not shown) of the lock bar **60** and prevent the collar **63** from further rotation, thus providing a positive lock to prevent the collar from rotation.

FIG. **8** is a partial enlarged view of the digger **10** showing a bottom perspective view of the gearbox **12**. The block stop **81** is spaced apart from the flat side **66** of the collar **63** as discussed above, creating the gap **75**. The lock bar **60** is disposed within the gap **75**, and generally contacts the support plate **82** when the lock bar **60** is in the locked position.

The invention claimed is:

1. A gearbox lock mechanism for a post hole digger, the mechanism comprising:

a collar coupled to a lower end of a right angle gearbox, the collar rotatable upon operation of the gearbox, the collar comprising a semi-circular outer edge, the outer edge comprising a flat side;

a male-threaded nipple extending from the collar;

an auger shaft comprising female threads, the auger shaft releasably coupled to the male threaded nipple;

a lock bar coupled to the gearbox, the lock bar rotatable from a locked position whereby the lock bar is aligned with and contactable with the flat side of the outer edge of the collar, the lock bar rotatable to an unlocked position whereby the lock bar does not contact the flat side of the outer edge of the collar.

2. The mechanism of claim **1**, wherein the nipple is unitary with the collar.

3. The mechanism of claim **1**, further comprising a lock bar support, the lock bar support rigidly coupled to the gearbox between the gearbox and the collar, the lock bar rotatably coupled to the lock bar support via one or more fasteners.

4. The mechanism of claim **3**, the lock bar support further comprising a support plate, the support plate comprising a generally flat plate coupled to the gearbox via a plurality of fasteners.

5. The mechanism of claim **4**, the lock bar support further comprising a block stop rigidly affixed to the support plate adjacent to the lock bar when the lock bar is in the locked position, the block stop comprising a substantially rectangular box.

6. The mechanism of claim 5, the block stop substantially parallel to the flat side of the outer edge of the collar when the collar is locked, the block stop spaced apart from the flat side of the outer edge of the collar by a distance.

7. The mechanism of claim 6, wherein a width of the lock bar is slightly less than the distance, such that the lock bar fits between the flat side of the outer edge of the collar and the Hock stop when the lock bar is in the locked position.

8. A gearbox lock mechanism for a post hole digger, the mechanism comprising:

a collar extending beneath the gearbox, the collar rigidly affixed to a nipple that releasably affixes a shaft of the post hole digger to the gearbox, the collar rotatable upon operation of the gearbox, the collar comprising a semicircular outer edge, the outer edge primarily semicircular and the outer edge comprising a flat side;

a lock bar support rigidly coupled to an outer body of the gearbox, the outer body of the gearbox not rotatable upon operation of the gearbox;

a lock bar rotatably coupled to the lock bar support via a fastener, the lock bar extending downwardly from the lock bar support when the lock bar is in an unlocked position such that the post hole digger is operational, the lock bar positioned adjacent to and contactable with the flat side of the outer edge of the collar when the lock bar is in a locked position, thus preventing the shaft of the post hole digger from rotation.

9. The mechanism of claim 8, the lock bar support comprising a support plate, the support plate comprising a generally flat plate coupled to the outer body of the gearbox via a plurality of fasteners.

10. The mechanism of claim 9, the lock, bar support further comprising a block stop rigidly affixed to the support plate adjacent to the lock bar when the lock bar is in the locked position, the block stop comprising a substantially rectangular box.

11. The mechanism of claim 10, the block stop substantially parallel to the fiat side of the outer edge of the collar when the collar is locked, the block stop spaced apart from the flat side of the outer edge of the collar by a distance.

12. The mechanism of claim 11, wherein a width of the lock bar is slightly less than the distance, such that the lock bar fits between the flat side of the outer edge of the collar and the block stop when the lock bar is in the locked position.

13. A gearbox lock mechanism for a post hole digger, the mechanism comprising:

a collar coupled with a gearbox shaft and rotatable with the gearbox shaft, the collar comprising a flat side on its outer edge;

a rotatable lock bar engagable with the fiat side of the collar, the lock bar adjacent to and contacting the flat side when the lock bar is in a locked position, the lock bar preventing rotation of the gearbox shaft when the lock bar is in the locked position.

14. The mechanism of claim 13, further comprising a lock bar support, the lock bar support rigidly coupled to an outer body of the gearbox, the lock bar rotatably coupled to the lock bar support via one or more fasteners.

15. The mechanism of claim 14, the lock bar support further comprising a support plate, the support plate comprising a generally flat plate coupled to the gearbox via a plurality of fasteners.

16. The mechanism of claim 15, the lock bar support further comprising a block, stop rigidly affixed to the support plate adjacent to the lock bar when the lock bar is in the locked position, the block stop comprising a substantially rectangular box.

17. The mechanism of claim 16, the block stop substantially parallel to the flat side of the outer edge of the collar when the collar is locked, the block stop spaced apart From the flat side of the outer edge of the collar by a distance.

18. The mechanism of claim 17, wherein a width of the lock bar is slightly less than the distance, such that the lock bar fits between the flat side of the outer edge of the collar and the block stop when the lock bar is in the locked position.

* * * * *